SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
MONITORING AND ANALYSIS

Boyle Heights PM_{10} Monitoring Study

Sampling Conducted
December, 2000, to February 2001

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EXECUTIVE SUMMARY

Purpose

Boyle Heights residents have expressed concerns to the AQMD about the potential for increased air pollution in their community due to freeway traffic. In response, the AQMD initially conducted a two-month sampling (June 29 to August 16, 2000) program following the MATES II protocol[1.] This protocol[1] which calls for the sampling and analysis for a variety of volatile organic gases, carbonyl compounds, elemental carbon, hexavalent chromium as well as microscopic analysis of ambient particulate matter was conducted by placing a monitoring platform on the grounds of Salesian High School. This report was issued in October 2000.

In addition a two-month particulate follow-up monitoring program was undertaken from December 2000 to February 2001 to assess existing PM_{10} levels including elemental carbon (EC), with comparisons to a nearby site (Central LA, which is a regular network site). Elemental carbon is an indicator of diesel soot, the primary contributor to ambient airborne cancer risks in the South Coast Air Basin, as described in the MATES-II[1] study. This report documents the findings from the follow-up program.

Sampling

Sampling was conducted in Boyle Heights coincident with the AQMD PM_{10} monitoring network one-in-six day schedule from December 14, 2000 through February 6, 2001. Three sites, two mobile monitoring and one AQMD PM_{10} network site were selected for carbon analysis and data comparison. The two mobile sites, the Breed St. cul-de-sac and 2400 block of 7th St., were the particulate monitoring sites chosen in the Boyle Heights area. The third site, Los Angeles, was selected to represent conditions within the urban core. The Breed St. and 7th St. sites were sampled with portable MiniVol samplers in order to locate monitors close to residences. While these are not Federal Reference Method (FRM) samplers, studies have shown that with proper adjustments and modifications, they correlate well to FRMs under medium to heavy PM concentrations.

Key Findings

1. Boyle Heights PM_{10} levels were similar to levels observed in Central Los Angeles.

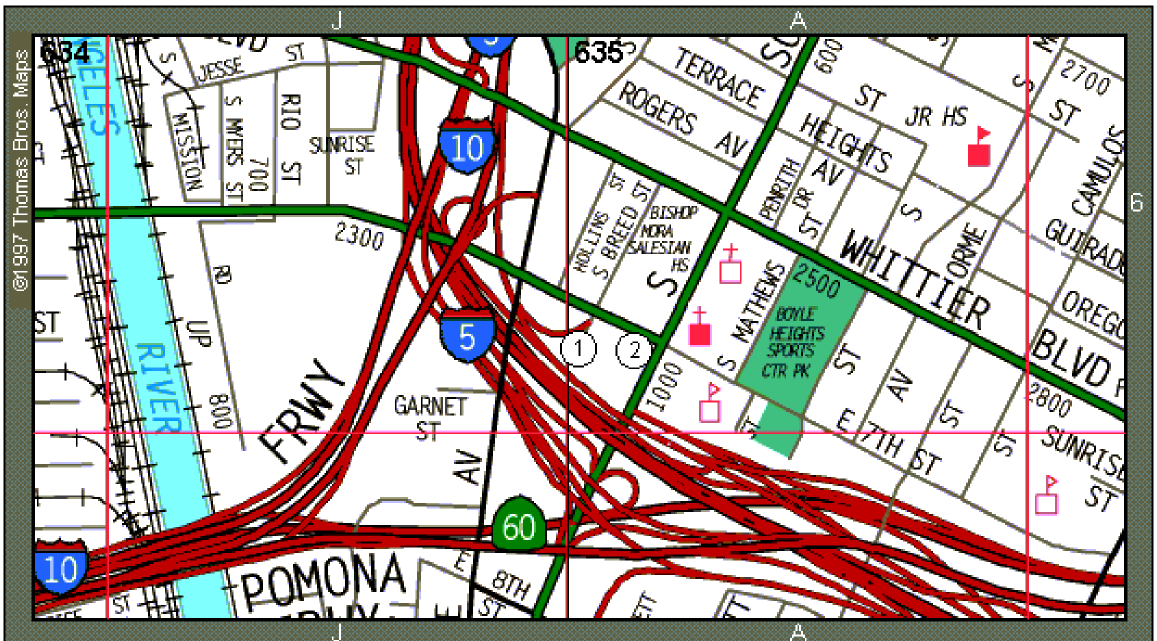
2. On average, EC concentrations in the Boyle Heights area were slightly higher than levels measured in Los Angeles, though on some days, elemental carbon at Boyle Heights was lower than Los Angeles. This suggests that particulate influences from diesel emissions are not much different than contributing sources in Los Angeles.

[1] South Coast Air Quality Management District. (November 1999). *Multiple Air Toxics Exposure Study in the South Coast Air Basin (MATES-II)*. Diamond Bar, CA

3. Organic carbon (OC) levels in Boyle Heights were discernibly higher than levels measured in Los Angeles. Results from other research[2] suggest that re-entrained road dust, contributing to organic particles, are affected to a greater degree in Boyle Heights than in Los Angeles.

4. Insufficient data are available for concluding statistical significance of these findings. However, the nature of these measurements can be used as indicators of the reported conditions.

Boyle Heights Sampling Site Map



Site #1 Breed St. cul-de-sac LA, 90023. **Site #2** 2474 E. 7th St. LA, 90023.

1.0 PURPOSE AND SCOPE

The AQMD conducted an ambient particulate-monitoring program from December 2000 through February 2001 in response to concerns expressed by members of the community of Boyle Heights, regarding the impact of increased diesel truck traffic in their area.

In order to assess the suggested new existing conditions (as opposed to the conditions existing in the previous study) in Boyle Heights, the AQMD initiated sampling of particulate matter less than 10 microns in aerodynamic diameter (PM_{10}). Samples collected were analyzed for mass, from which ambient PM_{10} concentrations were calculated – and for carbon, including speciation of OC and EC fractions. Of these two carbon species, EC is associated with transportation sources and with diesel engines in

[2] Schauer, J.J., Rogge, W.F., Hildemann, L.M., Mazurek, M.A., Cass, G.R. Source Apportionment of Airborne Particulate Matter Using Organic Compounds as Tracers. Atmospheric Env., 1996 30 (22): 3837-3855.

particular. EC has been used to estimate the air toxic cancer risks attributable to diesel particulate.[3] Consequently, the ambient concentration of EC in Boyle Heights was a key focus of this study.

Concurrent with the Boyle Heights samples, samples were taken and analyzed from a site in Central Los Angeles. The results are presented and compared in this report. (Please refer to Fig. 6 on page 10).

2.0 PROJECT DISCUSSION

Samples were collected on a one-in-six day sampling schedule, coinciding with PM_{10} network sampling dates, from December 14, 2000 through February 6, 2001. The resulting data set consists of 6 samples at each of 3 sampling sites for a total of 18 samples, with the last sample at the 7th Street site being invalidated due to insufficient run time caused by battery failure.

2.1 Description of Analytical Methods

2.1.1 Size-Selective Inlet (SSI) Sampler

The SSI sampler used for comparison in this study is the EPA's federal reference method (FRM) sampler found in 40CFR50 Appendix J. It is used to monitor PM less than 10 microns in size (PM10). For the purposes of this study, the SSI sampler used to collect PM_{10} samples, which were also used for the determination of organic carbon (OC), elemental carbon (EC) and total carbon. This sampler is located at the Central Los Angeles site.

The SSI sampler contains a pump controlled by a programmable timer. An elapsed time accumulator, linked in parallel with the pump, records total pump-operation time in hours. During operation, a known quantity of air is drawn through a particle size separator, which achieves particle separation, by impaction. The correct flow rate through the inlet is critical to collection of the correct particle size so that after impaction, only particles 10 microns in size or less remain suspended in the airstream. The flow of air then passes through a quartz filter medium, upon which the particles are collected. A programmable timer automatically turns the pump off at the end of the 24-hour sampling period.

2.1.2 MiniVol Sampler

The MiniVol portable samplers used at 7th Street and Breed Street are devices for monitoring $PM_{10.}$ Small in size, lightweight, and battery operated, the sampler is ideal for monitoring in remote areas or areas where no permanent site has been established. The MiniVol portable sampler is basically a pump controlled by a programmable timer which can be set up to make six "runs" within 24 hours, or

[3] South Coast Air Quality Management District. (November 1999). *Multiple Air Toxics Exposure Study in the South Coast Air Basin (MATES-II)*. Diamond Bar, CA

throughout a week. The sampler can operate from a battery pack making the sampler independent of line power. In the PM_{10} sampling mode, air is drawn through a particle size separator and then through a filter medium. Particle separation is achieved by impaction. The inlet tube downstream from the filter conducts the air to the twin cylinder diaphragm pump. From the pump, air is forced through a standard rotameter where it is exhausted to atmosphere inside the pump body. The programmable timer will automatically turn the pump off at the end of a sampling period.

2.1.3 PM_{10} Analysis

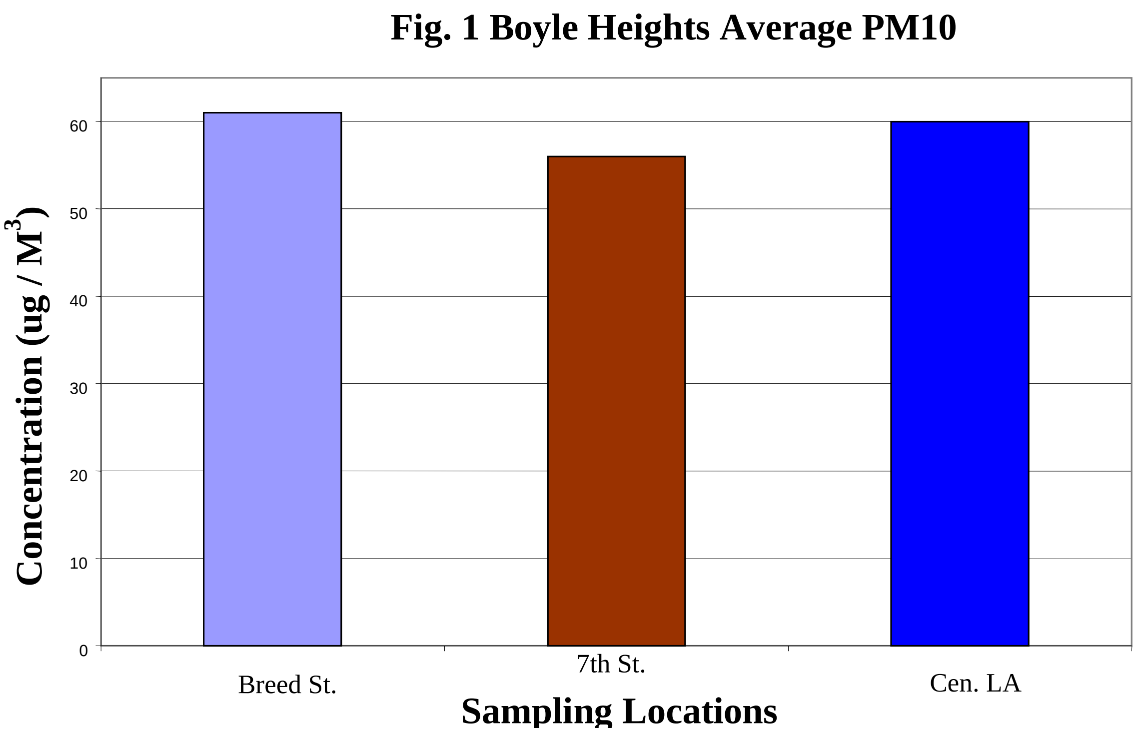
Once a sample has been collected it is returned to the laboratory, following chain-of-custody protocols, where both PM_{10} mass and carbon content are determined. Ambient PM_{10} mass is determined by subtracting the weight of the clean unsampled filter (measured in the laboratory prior to sampling) from the weight of the sampled filter containing the collected PM_{10}, to yield the mass of the PM_{10} collected on the filter. This mass is then divided by the amount of air drawn through the filter to give the ambient concentration, expressed as mass per cubic meter ($\mu g/m^3$).

2.1.4 Carbon Analysis

Ambient carbon levels are determined by taking a small portion of the PM_{10} filter and putting it into a carbon analyzer. The analyzer consists of a computer-controlled programmable oven, computer controlled gas flows, a laser, and a flame ionization detector (FID). The sample is first heated in the oven in increasing amounts of oxygen. As the temperature rises, first organic carbon and then elemental carbon are evolved from the filter. The laser beam passes through the filter, and the transmitted intensity increases at the detector as the light-absorbing carbon leaves the filter, causing the filter to become less black. The evolved carbon is swept from the oven by gas flow, and is transported to the FID where it is detected (in the form of methane) throughout the heating process. The computer that controls these processes collects data on the oven temperature profile, laser light absorption, and FID response to determine the OC and EC content of the filter. This information, combined with the volume of air sampled, provides the OC and EC concentration in the ambient air.

The selection of the PM_{10} network site for inclusion in the study was based on several factors. Basin particulate pollution patterns observed in the past include an increase in PM_{10} from west to east and a decrease in the percentage of elemental carbon in PM_{10} from west to east. These trends correspond to a decreasing west-to-east gradient of heavy-duty vehicle traffic. Central Los Angeles was selected for the study by virtue of its location with respect to Boyle Heights. Central Los Angeles was selected for the high concentration of heavy-duty vehicle traffic, and typically a higher level of ambient EC observed in the metropolitan area.

3.0 DATA ANALYSIS



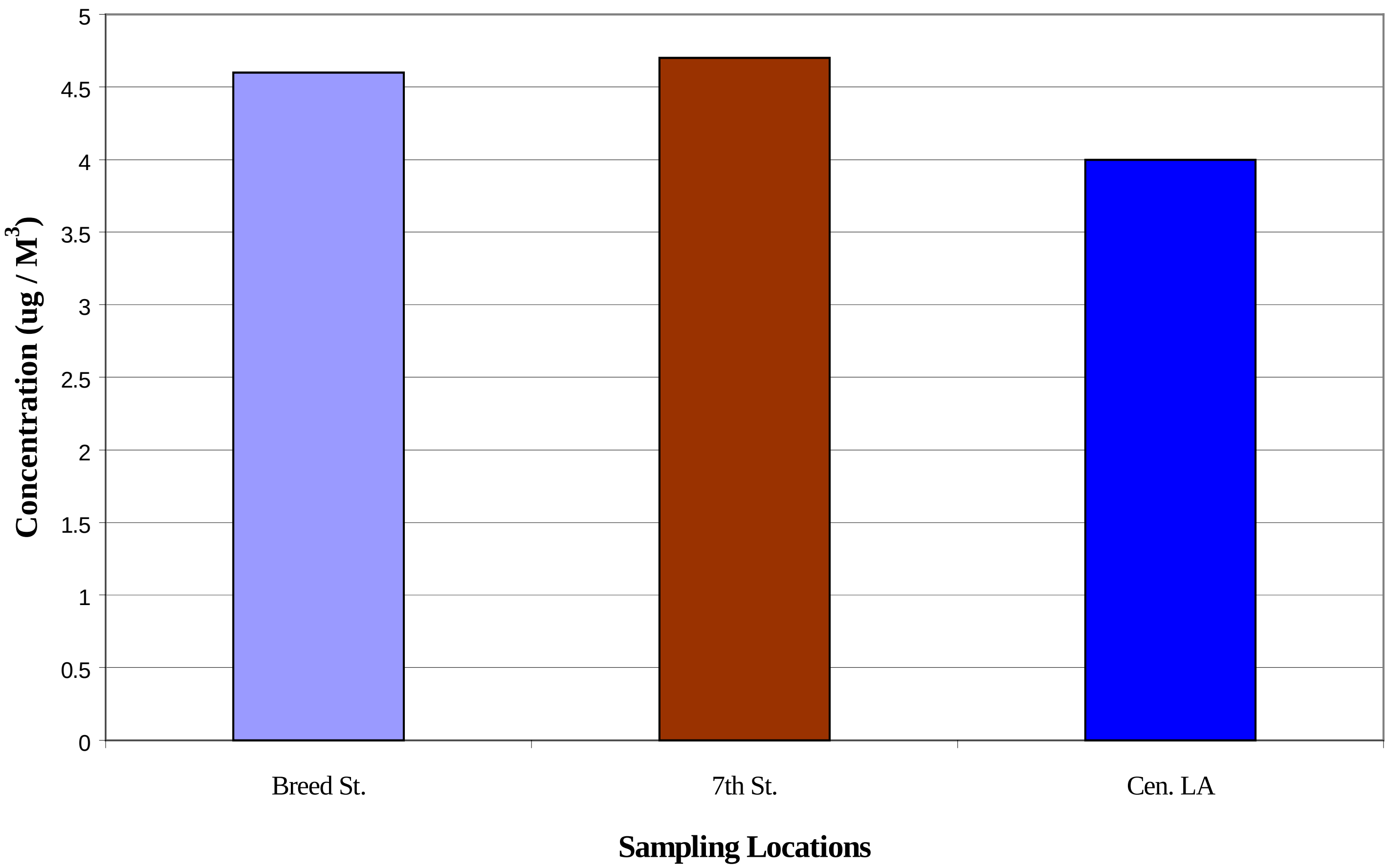
3.1 PM10 AMBIENT CONCENTRATION ANALYSIS

PM_{10} concentrations were obtained for each site over the duration of the study, and results are presented in Fig. 1 above. (Complete data tabulation can be found in Appendix I.) The Boyle Heights concentrations are very similar to those measured in Central Los Angeles.

When looking at these results, it must be kept in mind that PM_{10} consists of a variety of chemical species.[4] These include carbonaceous components (EC and OC); crustal materials and wind-blown soils; sulfate and nitrate formed by precursor oxides of sulfur and oxides of nitrogen emissions primarily as a result of combustion.

[4] Kim. B.M., Teffera, S., Zeldin, M.D. Characterization of $PM_{2.5}$ and PM_{10} in the South Coast Air Basin of Southern California: Part 1 – Spatial Variations; *J. Air and Waste Manage. Assoc.* **2000** 50:2034-2044.

Fig. 2 Boyle Heights Average Elemental Carbon Data

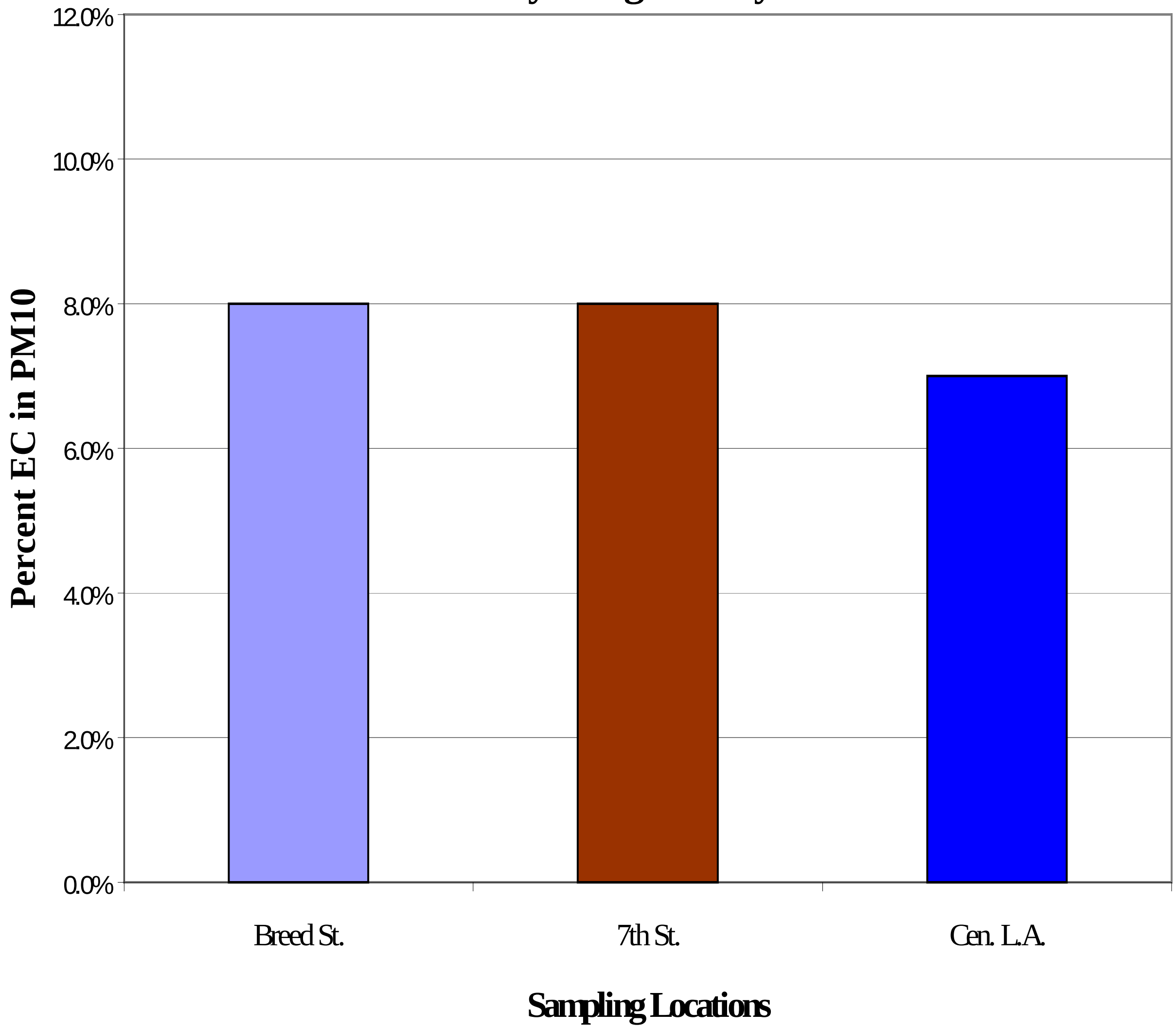


3.2 ELEMENTAL CARBON ANALYSIS

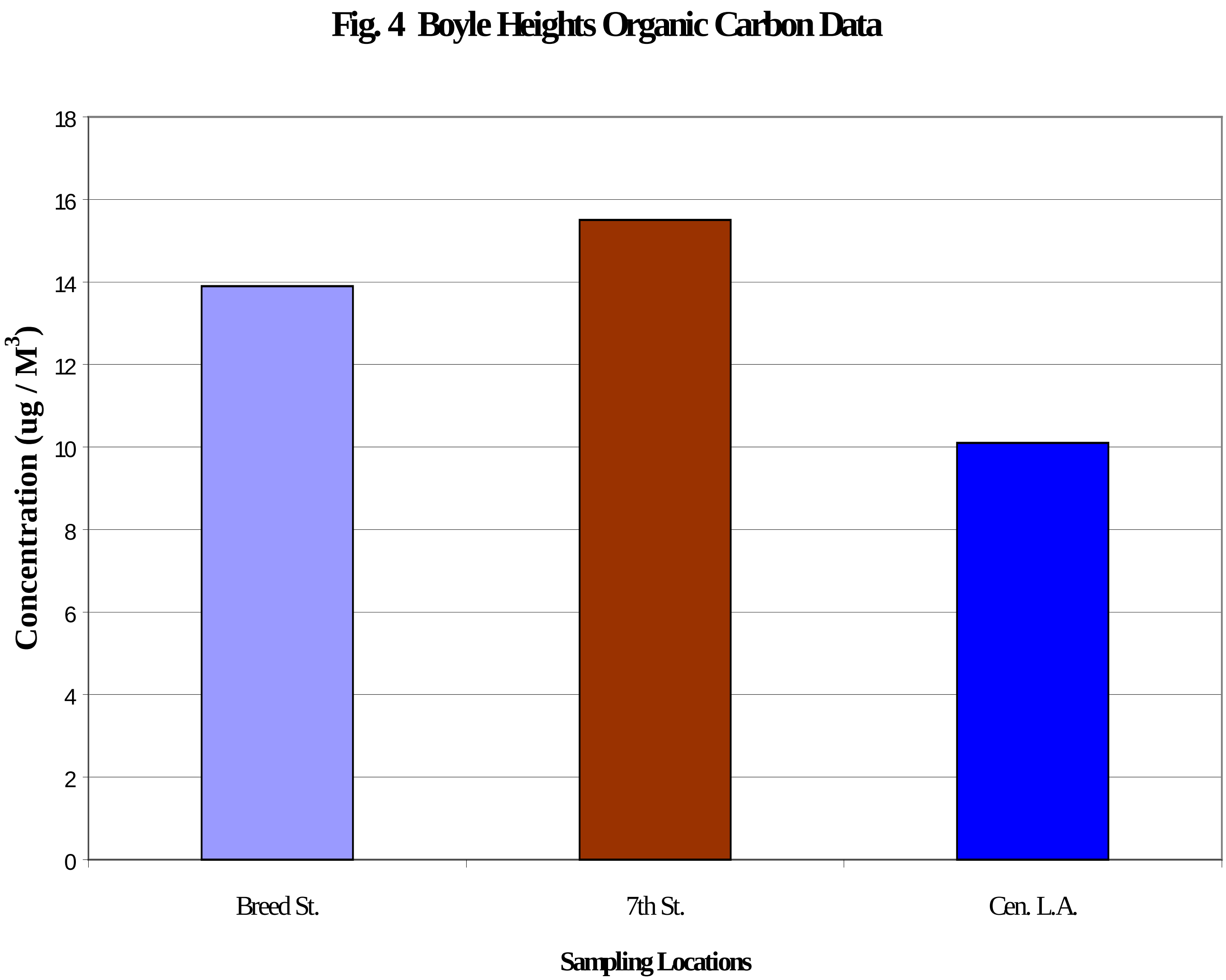
Elemental carbon concentrations were obtained for each site over the duration of the study, and results are presented in Fig. 2 above. Elemental carbon is the key indicator for estimating the influence from diesel particulate. (Complete data tabulations can be found in Appendix I.) The EC concentrations, for the Boyle Heights sites were slightly higher (e.g. about 10-15% higher) than that observed at the Central LA site, but within experimental error of the methods used. Using EC as a diesel surrogate, the Boyle Heights values do not indicate a substantially heavier diesel influence as compared to Central LA. This observation suggests that the ambient EC concentrations in Boyle Heights are generally consistent with similar locations in the central portion of the Basin, as shown in the MATES-II study. It should be noted that the EC data provided by the current study are suggestive, not definitive, of cause.

The magnitude of the difference in EC concentration from site to site is not large. As shown in figure 3, the average percentage of EC as part of PM_{10} at each site over the sampling period shows similar results to figure 2. The difference of 1% emphasizes how close these measurements are as a function of sampling locations.

Fig. 3 Percent EC in PM_{10}
Boyle Heights Study



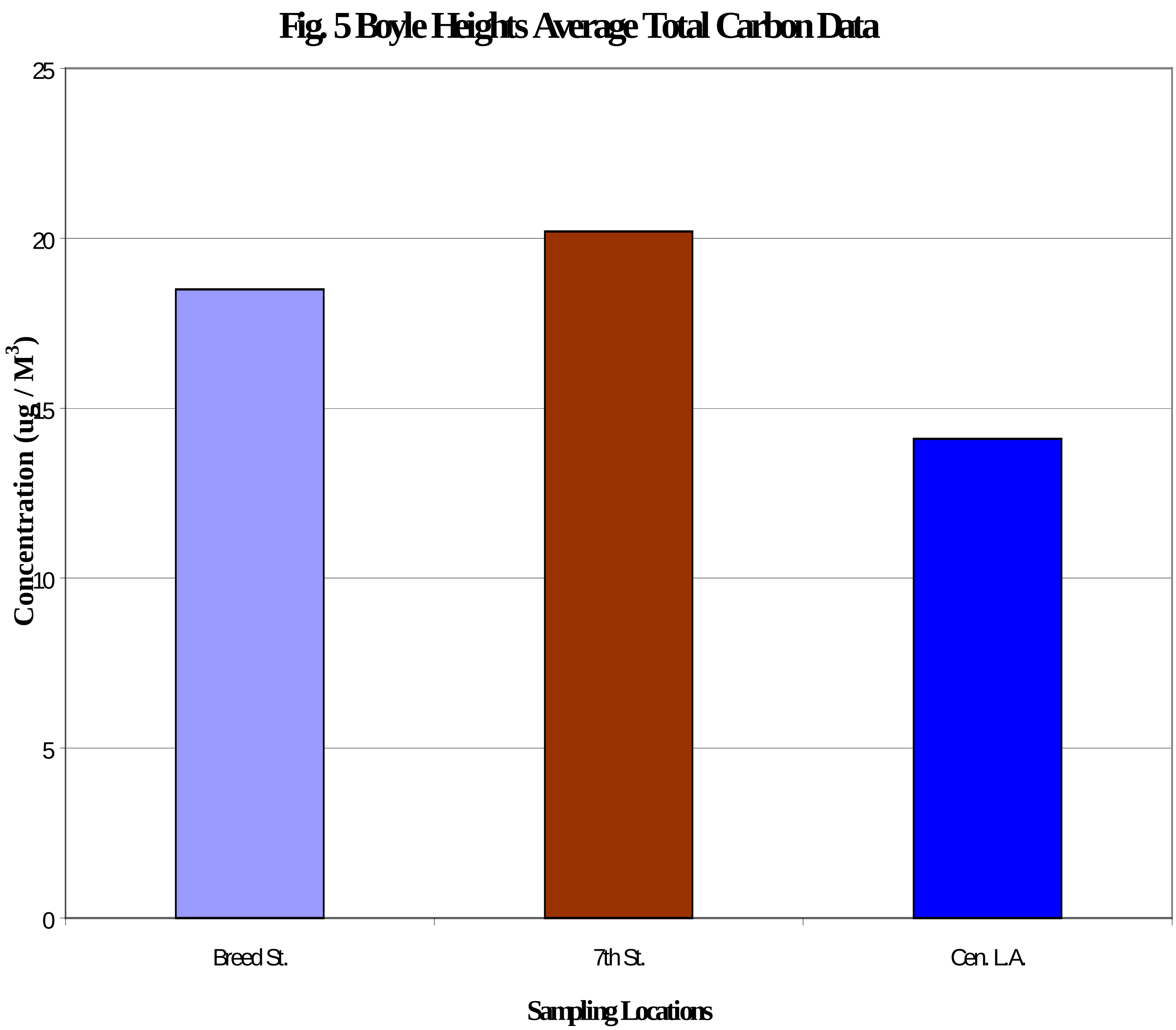
3.3 ORGANIC CARBON ANALYSIS



Organic carbon concentrations were measured for each site over the duration of the study, and results are presented in Fig. 4 above. Complete data tabulation can be found in Appendix I. The Boyle Heights sites had notably higher OC concentrations during the study, than did Central Los Angeles. This is consistent with the proximity of the community to a freeway, which other studies have shown to be a source of organic compounds by re-entrainment of road dust by moving vehicles.

The high OC levels also contribute to the relatively lower percentage of EC in PM_{10}, as discussed in section 3.2.

3.4 TOTAL CARBON ANALYSIS



Total carbon concentrations by sampling date and location are represented in Figure 5. Boyle Heights exhibited higher average total carbon result for the study period than did downtown LA. As the EC concentration was only slightly elevated (not elevated by a statistically significant amount), the higher total carbon value for Boyle Heights primarily reflects the higher OC value, discussed in section 3.3.

4.0 CONCLUSIONS

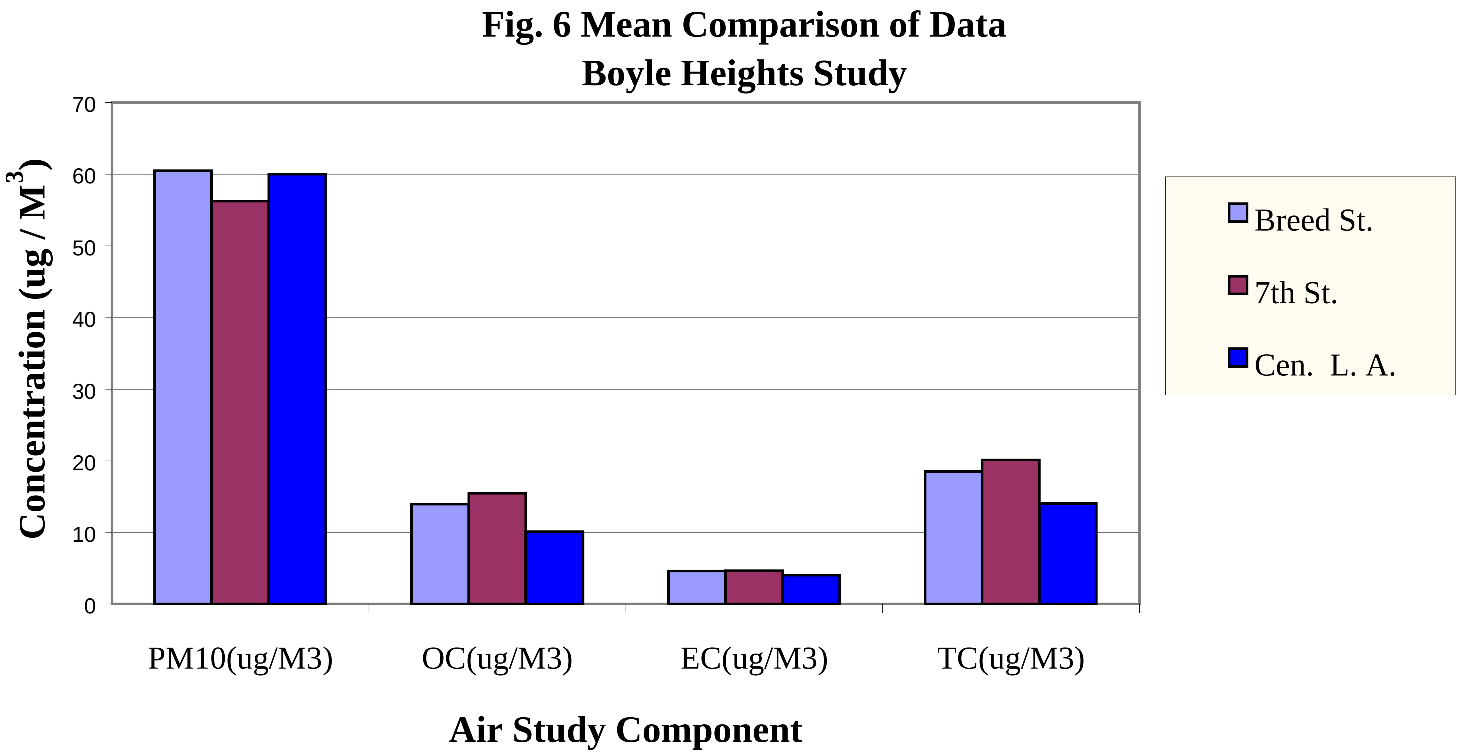


Figure 6 summarizes the pollutant concentrations comparing the two Boyle Heights locations to the AQMD air network-monitoring site in Central Los Angeles. The following conclusions are drawn for the study period:

1) Boyle Heights PM_{10} levels were similar to levels observed in Central Los Angeles.

2) On average, EC concentrations in Boyle Heights area were slightly higher than levels measured in Los Angeles, though on some days, elemental carbon at Boyle Heights was lower than Los Angeles. This suggests that particulate influences from diesel emissions are not much different than contributing sources in Los Angeles.

3) Organic carbon levels in Boyle Heights were discernibly higher than levels measured in Los Angeles. Results from other research suggest that re-entrained road dust, contributing to organic particles, are affected to a greater degree in Boyle Heights than in Los Angeles. This result is consistent with the proximity of the Boyle Heights monitors to adjacent freeways and on-ramps.

4) Total carbon is also discernibly greater at the Boyle Heights locations, primarily due to the greater level of organic carbon at these sites.

5) Insufficient data are available for concluding statistical significance of these findings. However, the nature of these measurements can be used as indicators of the reported conditions.

APPENDIX I BOYLE HEIGHTS PM10 MONITORING DATA

Site	Run Date	PM10(ug/M^3)	OC(ug/M^3)	EC(ug/M^3)	TC(ug/M^3)
Breed St. cul-de-sac	12/14/00	39	12.3	3.3	15.6
2474 E. 7th St.	12/14/00	37	15.5	4.2	19.7
Field Blank	12/14/00		7.3	1.0	8.3
Central L.A.	12/14/00	41	6.7	2.5	9.2
Breed St. cul-de-sac	12/20/00	60	14.6	5.8	20.4
2474 E. 7th St.	12/20/00	50	14.1	5.5	19.6
Central L.A.	12/20/00	79	13.7	6.1	19.8
Breed St. cul-de-sac	1/1/01	69	14.5	4.7	19.2
2474 E. 7th St.	1/1/01	74	15.2	4.7	19.9
Central L.A.	1/1/01	66	12.1	4.5	16.6
Breed St. cul-de-sac	1/7/01	74	14.3	4.5	18.8
2474 E. 7th St.	1/7/01	64	17.0	4.2	21.2
Central L.A.	1/7/01	65	9.2	4.6	13.8
Breed St. cul-de-sac	1/19/01	63	14.9	5.8	20.7
2474 E. 7th St.	1/19/01	Filter Damage	13.9	5.3	19.2
Central L.A.	1/19/01	60	11.3	3.6	14.9
Breed St. cul-de-sac	2/6/01	Filter Damage	13.1	4.5	17.6
2474 E. 7th St.	2/6/01	Filter Damage	*7.2	*2.4	*9.6
Field Blank	2/6/01	N/A	4.3	4.6	8.9
Central L.A.	2/6/01	52	7.5	2.4	9.9

*Filter Damage, results suspect

MEAN

	PM10(ug/M^3)	OC(ug/M^3)	EC(ug/M^3)	TC(ug/M^3)
Breed St. cul-de-sac	61	13.9	4.6	18.5
2474 E. 7th St.	56	15.5	4.7	20.2
Central L.A.	60	10.1	4	14.1